

Appl. No. 10/791,709
Amdt. dated January 23, 2006
Reply to Office action of September 27, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

5 Listing of Claims:

1. (currently amended) An ESD protection configuration for light emitting diodes (LED), comprising:

a resistor, having a first end connected to an n-node of an LED; and

10 a capacitor, having a first end connected to a second end of the resistor and a second end connected to a p-node of the LED, wherein the LED, resistor and capacitor are mounted unto a circuit substrate, such that the resistor and the capacitor are disposed outside the circuit substrate and connected to the LED via the circuit substrate to form an RC circuit;

15 whereby the RC circuit engaging a parallel connection with the LED is able to guard the LED against spikes, absorb and remove ESD and prevents the LED from burning to effectively extend the lifespan of the LED.

2. (canceled)

- 20 3. (currently amended) An ESD protection configuration for light emitting diodes (LED), comprising:

a resistor, having a first end connected to an n-node of an LED; and

25 an equivalent capacitor, equivalent to a capacitor having a first end connected to a second end of the resistor and a second end connected to a p-node of the LED, wherein the LED, resistor and equivalent capacitor are mounted unto a circuit substrate, such that the resistor and the equivalent capacitor are disposed inside the circuit substrate and connected to an p-n junction of the LED via the circuit substrate to form an RC circuit;

Appl. No. 10/791,709

Amdt. dated January 23, 2006

Reply to Office action of September 27, 2005

whereby the RC circuit engaging a parallel connection with the LED is able to guard the LED against spikes, absorb and remove ESD and prevents the LED from burning to effectively extend the lifespan of the LED.

5 ~~The ESD protection configuration for LED of Claim 1, wherein the resistor and an equivalent capacitor are disposed inside the circuit substrate and connected to an p-n junction of the LED via the circuit substrate.~~

10 4. (original) The ESD protection configuration for LED of Claim 3, wherein the equivalent capacitor includes a first capacitor and a second capacitor that are connected in series and has an equivalent capacitance represented by the formula, $1/C=1/C_1+1/C_2$.

15 5. (original) The ESD protection configuration for LED of Claim 3, wherein the p-n junction of the LED and the p-n junction of the circuit substrate are provided with a metal conductive layer and an insulator.

20 6. (original) The ESD protection configuration for LED of Claim 1, wherein the capacitor is made of a material having a high dielectric constant greater than 3.9.

25 7. (original) The ESD protection configuration for LED of Claim 5, wherein the material having a high dielectric constant is selected from one of the group consisting of: SiN_x , SiO_2 , TiO_2 , TiN and BaTiO_3 , or their series material with dielectric constant be higher than 3.98.

8. (original) The ESD protection configuration for LED of Claim 1, wherein the resistor has an ideal resistance of $1\text{K}\Omega$.

Appl. No. 10/791,709

Amdt. dated January 23, 2006

Reply to Office action of September 27, 2005

9. (original) The ESD protection configuration for LED of Claim 1, wherein the LED is a high speed semiconductor, such as Groups III-V nitride semiconductors containing InGaN.
- 5 10. (original) An ESD protection configuration for LED, comprising:
an LED, having a p-n junction and connected to a circuit substrate, the circuit
substrate having two p-type substrates and one n-type substrate therein;
a first ESD protection configuration, built-in the circuit substrate and including
a first resistor, a first capacitor and a first diode that are connected in series and
10 then engage a parallel connection with the LED, wherein the first diode has a
p-node connected to an n-node of the LED; and
a second ESD protection configuration, built-in the circuit substrate and
including a second resistor, a second capacitor and a second diode that are
connected in series and then engage a parallel connection with the LED and the
15 first ESD protection configuration, wherein the second diode has a p-node
connected to the p-node of the LED.
11. (original) The ESD protection configuration for LED of Claim 10, wherein the
first capacitor has a first capacitance greater than a second capacitance of the
20 second capacitor.
12. (original) The ESD protection configuration for LED of Claim 11, wherein the
first capacitance ranges between 100pF and 100nF.
- 25 13. (original) The ESD protection configuration for LED of Claim 11, wherein the
second capacitance ranges between 100pF and 100nF.
14. (currently amended) The ESD protection configuration for LED of Claim 10,

Appl. No. 10/791,709
Amdt. dated January 23, 2006
Reply to Office action of September 27, 2005

wherein the first capacitor includes a third capacitor and a fourth capacitor that are connected in series and has an equivalent capacitance represented by the formula,

$$1/(C_{\text{first capacitor}}) = 1/(C_{\text{third capacitor}}) + 1/(C_{\text{fourth capacitor}}).$$

5

15. (currently amended) The ESD protection configuration for LED of Claim 10, wherein the second capacitor includes a fifth capacitor and a sixth capacitor that are connected in series and has an equivalent capacitance represented by the formula,[[:]]

10 $1/(C_{\text{second capacitor}}) = 1/(C_{\text{fifth capacitor}}) + 1/(C_{\text{sixth capacitor}}).$

16. (original) The ESD protection configuration for LED of Claim 10, wherein the capacitor is made of a material having a high dielectric constant greater than 3.9.

15

17. (original) The ESD protection configuration for LED of Claim 16, wherein the material having a high dielectric constant is selected from one of the group consisting of: SiN_x, SiO₂, TiO₂, TiN and BaTiO₃.

- 20 18. (original) The ESD protection configuration for LED of Claim 10, wherein the first resistor and the second resistor are made of a material having a low dielectric constant.

- 25 19. (original) The ESD protection configuration for LED of Claim 10, wherein the first resistor and the second resistor each have an ideal resistance of 1KΩ.

20. (original) The ESD protection configuration for LED of Claim 10, wherein the first diode and the second diode are constructed the two p-type substrates and

Appl. No. 10/791,709
Amdt. dated January 23, 2006
Reply to Office action of September 27, 2005

the n-type substrate in the circuit substrate.

21. (original) The ESD protection configuration for LED of Claim 10, wherein the LED is a high speed semiconductor, such as Groups III-V nitride semiconductors containing InGaN.
22. (withdrawn) An ESD protection method for LED, comprising the steps of:
- providing a resistor, the resistor having a first end connected to an n-node of an LED; and
 - providing a capacitor, the capacitor having a first end connected to a second end of the resistor and a second end connected to a p-node of the LED to form an RC circuit;
- whereby the RC circuit engaging a parallel connection with the LED is able to guard the LED against spikes, absorb and remove ESD and prevents the LED from burning to effectively extend the lifespan of the LED.
23. (withdrawn) An ESD protection method for LED, comprising the steps of:
- providing an LED, the LED having a p-n junction and connected to a circuit substrate, the circuit substrate having two p-type substrates and one n-type substrate therein;
 - providing a first ESD protection configuration, built-in the circuit substrate and including a first resistor, a first capacitor and a first diode that are connected in series and then engage a parallel connection with the LED, wherein the first diode has a p-node connected to an n-node of the LED; and
 - providing a second ESD protection configuration, built-in the circuit substrate and including a second resistor, a second capacitor and a second diode that are connected in series and then engage a parallel connection with the LED and the first ESD protection configuration, wherein the second diode has a

Appl. No. 10/791,709

Amdt. dated January 23, 2006

Reply to Office action of September 27, 2005

p-node connected to the p-node of the LED₁